HiPerMeGaFlowS: High-Performance Curved Meshing and Unstructured High-Order Galerkin Solvers for High-Fidelity Flow Simulation

Description

High-fidelity flow simulation is one of the main goals to pursue in the research towards exascale computing. This capability will allow a cheaper exploration of aeronautical and automotive designs that fulfill energy consumption and noise emissions policies of the European agencies. In this project, the integration of three high-performance tools will be studied as a promising alternative to perform high-fidelity flow simulations.

Specifically, a parallel curved unstructured mesh generator will be integrated with two different parallel high-order stabilized Galerkin solvers. We expect that the novel research on the development and combination of these high-performance tools will provide the physical, numerical, and geometrical accuracy required to perform high-fidelity flow simulations on complex domains defined by industrial computer-aided design models. Furthermore, the project is of major interest in high-performance computing since we expect to improve the scalability of implicit flow solvers by increasing the accuracy for a given computational cost, favoring computation to data transfer, and increasing the ratio of operations that scale linearly with the number of mesh elements. The combined tools willbe deployed in a large cluster to obtain flow simulations of practical interest for the aeronautical and automotive industries.

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